

Case Closed? Where the Water on a Cold Can Comes From

Learning target: I can write a claim-evidence-reasoning argument, using test data and a particle model, that explains where the water on a cold container comes from and why it forms.

Claim, evidence, reasoning

About 45 min

Individual

MS-PS1-4 · assesses

writing

data analysis

Name _____

Date _____

Period _____

Directions

In W1 you wrote a first explanation for the drops on a cold can. Now a class has run controlled tests. Read the scenario and the data table carefully; the numbers are a teaching dataset. Do the warm-up first, because it organizes your evidence. Then write your argument in the claim, evidence and reasoning boxes, and finish by answering a rival explanation.

You will need: This worksheet, Pencil, Highlighter (optional)

The scenario

Ms. Ortiz's class wanted to settle the question from W1. They set up six tests in a classroom kept at 25 °C. Each container sat on a dry dish on an electronic balance, so any drops that formed, even ones that dripped onto the dish, stayed on the balance. After 15 minutes, students read the change in mass first, recorded whether drops formed, and only then pressed a white paper towel against the drops to check their color. A humidity meter showed how much water vapor the air held.

Reading the humidity meter — The meter gives a percent: how much water vapor is in the air compared with the most the air could hold at that temperature. A higher percent means more water vapor in the air. The dry box was a sealed clear plastic box with packets of drying crystals inside, which pull water vapor out of the air.

Six tests of cold and room-temperature containers, 15 minutes each (teaching dataset)

Simulated teaching dataset: the numbers are invented to be realistic, not measured.

Test	Container	Starting surface temperature (°C)	Air around it (humidity reading)	Drops after 15 min?	Color on white towel	Mass change (g)
A	Sealed can of purple grape juice from the refrigerator	4	Classroom air, humid day (60%)	Many drops, some dripped	Clear	+0.8
B	Sealed can of purple grape juice at room temperature	25	Classroom air, humid day (60%)	None	Nothing to blot	0.0
C	Sealed glass jar of plain tap water from the refrigerator	4	Classroom air, humid day (60%)	Many drops	Clear	+0.7
D	Sealed can of purple grape juice from the refrigerator	4	Inside the dry box (under 5%)	None	Nothing to blot	0.0
E	Sealed can of purple grape juice from the refrigerator	4	Classroom air, dry day (30%)	A faint mist in the first minutes that soon disappeared; no drops	Nothing to blot	0.0
F	Sealed empty can (air only) from the refrigerator	4	Classroom air, humid day (60%)	Mist and small beads for about 4 minutes, then they dried	Clear (blotted at minute 2)	0.0

Simulated data for teaching. The pattern matches what real tests show; the exact numbers were invented. Mass was read to the nearest 0.1 g.

Warm-up: organize the evidence

1. In test A the container and dish had a mass of 391.4 g at the start. What was the mass after 15 minutes? Then think it through: if juice had leaked out through the metal onto the outside of the can and the dish, what would the mass change have been, and why?

2. Sort the tests. Write the test letters in the cells and be ready to explain each choice.

Tests that support it	Tests that contradict it
The water came from inside the container.	
The water came from water vapor in the air.	

3. Which two tests are the best fair comparison to show that the container's temperature matters? Which two show that the amount of water vapor in the air matters? For each pair, name what was kept the same.

Your argument

CLAIM

Claim: In one or two sentences, state where the water on the outside of a cold container comes from and what change of state forms it.

EVIDENCE

Evidence: Give at least three specific pieces of evidence from the table, using test letters and numbers. At least one must use the mass data, and at least one must compare two tests that differ in only one way.

REASONING

Reasoning: Explain why your evidence supports the claim. Describe which way energy moves as heat between the air and the cold surface and why, what happens to the motion of the water vapor particles, and why they end up as liquid. Use the words temperature, heat and thermal energy correctly at least once each.

Answer a rival explanation

4. A classmate still says, 'The juice soaks through tiny holes in the can.' Write a respectful reply that uses two different tests to show why the data do not support this idea.

5. Predict test G: a sealed can of grape juice taken from a freezer at -15°C and set out in the humid classroom. What would form on it, what is that change of state called, and would the mass go up, go down or stay the same? Explain.

Sentence frames for the argument

Claim: 'The water on the outside of a cold container comes from _____. It forms when _____ changes from a _____ to a _____, which is called _____.' Evidence: 'In test _____, _____, but in test _____, _____.' 'The mass in test A went up by _____, which shows _____.' Reasoning: 'Because the air is warmer than the can, heat flows from _____ to _____. The water vapor particles lose thermal energy, so they _____. When they are slow enough, _____.'

How cold is cold enough?

In test E, the can was cold but only a faint mist formed. Weather reporters use the dew point: the temperature to which air must be cooled for its water vapor to start condensing. Using tests A and E, explain why air with less water vapor has a lower dew point. Then predict whether a can at 15 °C would sweat on the humid day of test A, and describe a test you could run to find the temperature at which the can just starts to fog.